TROPICAL AGRICULTURE

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THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE, TRINIDAD, B.W.I.

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INTER IMPERIAL CONFERENCES.

ON 13th May, the Rt. Hon. Colonel L. S. Amery, Secretary of State for the Colonies, will open in London a Conference composed of representatives of the British West Indian Colonies, British Guiana and British Honduras. The Conference has been called for the purpose of considering and reporting upon the desirability of setting up a Standing Conference, with a permanent secretariat, to act in an advisory capacity on matters of common concern. The event is full of significance and, we hope, of happy augury for the future. Since the deposition of "King Sugar" the British West Indies have never made their voice effective in the councils of the Empire. Those most intimately connected with the welfare of our Colonies in this part of the world have long felt that the lack of unity which exists has been a strong impediment to more rapid development. Several schemes, some fantastic, others of a more practical nature, have been propounded for overcoming this obstacle. The Master of Elibank, whose intimate association with the West Indies placed him in a position to appreciate fully the disadvantages of the existing system, elaborated a scheme for the creation of a Federal Council endowed with legislative powers over certain delegated subjects. Since it did not prove acceptable to the interested Colonies the merits and demerits of his proposals need not be discussed here. The obstacles in the way of the formation of any federal authority armed with legislative powers over the whole of the British West Indies, British Guiana and British Honduras, appear, for the present, to be well-nigh insuperable. The Colonies differ radically in political constitution, racial composition, size, population, economic development and outlook, commercial products, physical characteristics, &c. The mere problem of distance still remains a formidable proposition.

Nevertheless there are problems of common interest to all, and ones which, moreover, can only be approached successfully in a co-operative spirit. Although the Colonies have remained implacably opposed to any and all proposals of political federation—a feeling engendered by something deeper than mere parochialism—they have always shown a disposition to co-operate upon questions of vital common concern. Sir Edward Davson's scheme is calculated to foster this spirit by creating a conference machinery which will meet at regular intervals to discuss those problems of common interest. The

conference will possess no legislative powers, but individual Colonies will have the satisfaction of knowing that subjects considered and actions recommended by this advisory body have been thoroughly ventilated and discussed by those best equipped to deal with them. The major item of the agenda will be a discussion upon the question of the appointment of a permanent conference machinery aided by a salaried secretariat, but, in addition, the opportunity will be seized of discussing such urgent problems as improved shipping facilities the marketing of West Indian produce in the United Kingdom, the establishment of a Customs Union, currency questions with special reference to the establishment of a West Indian Metal Currency and the establishment of a Trade Commissioner Service to consolidate and amplify the excellent work inaugurated at the British Empire Exhibition.

Our readers will have noted in our last issue that a conference with similar objects in view, was held at Nairobi in January by the Governors of Kenya, Uganda, Nyasaland and Tanganyika. This conference, which is claimed to have been the first of its kind in Imperial annals, was initiated at the suggestion of the East African Commission whose report was reviewed in our columns. The agenda was a comprehensive one and included consideration of an air survey of the Khartoum-Kissum route, wireless—external, inter-dependency and internal—postal services, roads—particularly trunk roads connecting the main territories—railway development, motor auxiliary road services, and lake and river transport. Other urgent problems of common concern which received the consideration of the East African Commission will doubtless be brought within the purview of the conference as its mechanism develops.

The importance of these conferences lies in the indication of a new spirit of approaching inter-imperial problems. The meeting of the Imperial Conference this autumn is a happy co-incidence and it is not unlikely that problems discussed by the sectional conferences which require the co-operation of larger interests will receive much fuller consideration than would otherwise have been the case. With the ability of these important groups to speak with unity once recognised and established one may eventually hope that they will receive direct representation upon the major Conference. Hitherto while areas of less absolute importance than the collective Colonies of the British West Indies, British Guiana and British Honduras, and East Africa have received direct representation at the Imperial Conference our tropical Colonies have depended upon indirect representation by the Secretary of State for the Colonies.

In spite of the sympathetic attitude happily characteristic of this minister, assisted by the expert advice of the permanent Officials of the Colonial Office, the Secretary of State is not in a position to urge their claims with the same cogency as those individuals whose life work has been connected with the economic life of these areas. The reasons for this differentiation are not far to seek, but, with the ability of the Colonies to speak with unity once clearly demonstrated, claims for direct representation will probably meet with a far more sympathetic reception. Whether this be so or not there can be no doubt that these group conferences can, if granted a full measure of co-operation, prove as beneficial to the Colonies immediately concerned as the Imperial Conferences have been to the Empire at large.

THE WEST INDIES.

Trade Representation.

FROM the report of the Committee of the West Indian and Atlantic Group of the British Empire Exhibition, we learn that a credit balance of £934 17s. has been realised. The report gives a somewhat detailed account of the exhibits at Wembley and the activities of the Group Committee, whose functions, by consent, have been carried out by the West India Committee since the 28th January, of this year. The report contains several far-reaching recommendations, which, if adopted would ensure a systematic continuation of the excellent propaganda which the products of the British West Indies, British Guiana, and British Honduras secured during the Empire Exhibition. It is recommended that an agency be established and controlled by the West India Committee (*a*) To watch and further the interest of the export trade of the Colonies represented, (*b*) To advise the Colonies represented regarding exhibitions, and to arrange for participation in suitable exhibitions, (*c*) To secure publicity and the support of the Press and to arrange for magazine articles, lectures, meetings and cinematograph displays, (*d*) To advertise the opportunities afforded by the Colonies represented for capitalists, settlers with adequate capital, and a development of the Tourist trade, (*e*) To provide an Information Bureau for replying to trade and other West Indian Tourist business, (*f*) To keep the Colonies represented fully acquainted with tariff, freight and other charges, and Legislative enactments affecting their products in the home country, and (*g*) To watch market opportunities and to scrutinise and report on the quality of shipments. The idea was first mooted, at the instance of the Trinidad Chamber of Commerce, in 1922. In the meantime, however, British Guiana, in common with many of the Dominions and Colonies, created her own Trade Commissionership in London, and the proposal of the West India Committee now is that the various West Indian Colonies and Bermuda need not wait until a unanimity of adhesion is secured, but that an immediate Trade Commissioner Service, with an Advisory Board truly representative of the Colonies falling in with the proposal,

should be set up "in the West End of London which would combine the business of popularising various kinds of West Indian produce—such as Jamaica coffee, Trinidad chocolate and the many other products for which a taste has already been created at Wembley—with that of bringing to public notice, by such means as the display of pictures and tropical scenery of the kind shown in the West Indian Pavilion, the attractions of the British West Indies as tourist resorts, and would act as a West End branch of the proposed Trade Commissioner Service." The West India Committee would be prepared to carry on the Trade Commissioner Service for a payment of £2,000 per annum to be subscribed jointly by the interested Colonies. It is obvious, however, that it was not intended, and it would not be sufficient, to cover the cost of the additional West End establishment nor the cost of any special activities which may be desired of any individual Colony.

EMPIRE COTTON.

THE report of the Executive Committee of the Empire Cotton Growing Corporation, which was to have been submitted to the meeting of the administrative council on 18th March last, contains a brief account of some of the activities of the Corporation.

The Chairman and Director were in the Sudan at the opening of the Makwar Dam, and the Vice Chairman was on a visit to Colombia and Peru at the invitation of the Governments of those countries, to investigate and report on the cotton growing possibilities. Reference is made to the far-reaching importance of the introduction of legislation during the present session of Parliament, to give effect to the decision of the Cabinet to recommend the issue of loans not exceeding ten million pounds, under the Imperial guarantee, to be devoted to transportation improvement and development in Eastern Africa.

In the Anglo-Egyptian Sudan, the far-reaching importance of the completion of the Makwar Dam is emphasised. In South Africa, reference is made to the effect of the abnormal rains of last season in changing the prospects of a magnificent cotton crop into a comparative failure. According to the latest figures, the cotton harvested in 1925 was practically double that of 1924. In Nigeria, the development of a Seed Farm, for which a manager has recently been appointed, is one of the developmental features, and trials of experimental track vehicles are being made with the view of developing mechanical transportation suitable to the extreme heat of the Nigerian climate. In Australia, it is reported that planting conditions were not very favourable, as October was dry and cold, with the result that only those farmers who had thoroughly prepared their land for planting were able to sow their seed early. The Corporation's Director of cotton cultivation and the Entomologist visited Papua and New Guinea at the request of the Governments of those territories, to advise with regard to experimental trials of cotton growing, and measures might be taken to control damage by insect pests. In Fiji, the Corporation has appointed an Agriculturist with special knowledge of cotton growing. In Southern Rhodesia it is stated that in spite of the abnormal wet season last year the settlers are by no means disheartened. The cotton specialist will be assisted by two assistants; one of whom it may be mentioned, was recently a post-graduate at the Imperial College of Tropical Agriculture. In Northern Rhodesia, an organisation has been set up to administer the fund provided in equal proportions by the Government and by the Corporation to assist planters who suffered through the loss of last year's cotton crop, owing to the abnormal rains. In addition to cash advances the Assistance Committee have distributed nearly 10 tons of cotton seed. In Nyasaland, considerable studies have been made towards the production of strains of cotton suitable for the areas in which this crop is planted in the highlands. Two small sub-stations at lower elevations will be appointed to test these strains before distributing to the Lower Shire and South Nyasa districts.

Reference is made to the development of the Cotton Research Station in Trinidad, an account of which was given in the April number of *Tropical Agriculture*.

INDIAN ECONOMIC CONFERENCE.

HIS Excellency Viscount Goschen, Governor of Madras, in opening the Ninth Session of the Indian Economic Conference expressed the hope that combined efforts of all interested would succeed in overcoming the great difficulty to be faced in the conservatism of the ryot, his lack of credit and the smallness of his sub-divided holdings. "To deal successfully with the first of these obstacles," His Excellency said, "it will be necessary to invoke the aid of public-spirited citizens, men of influence and position, more especially the big landholder, who could do much by example and demonstration to teach the value of up-to-date and scientific methods. For a partial solution of the credit question we may perhaps look to the development of co-operative banks, which are already doing something to meet this difficulty which confronts the small farmer in India. Increased productivity must, however, be the main foundation of improved credit. The 'fragmentation of holdings,' as it is termed, to which I have referred, is a real and pressing administrative problem. But it is engaging the attention of economists like yourselves, and we need not despair of some practical solution being found."

AGRICULTURAL EDUCATION.

THE following article is taken from *Nature* 30th January, 1926, where reference is given to the article on Land Grant College Education United States Bureau of Education Bulletin No. 4, 1925.

During the last half-century the importance of agricultural education has been increasingly recognised in America, until now every State has one or more agricultural colleges, forming a group of institutions occupying a prominent position in the field of education. During the decade 1910-1920 development was extraordinarily rapid, and very large sums of money were appropriated in many States for the provision of new agricultural buildings, the purchase of land and the endowment of educational programmes. The Colleges have had a long struggle for recognition, but have demonstrated their value and are now in such a position, financial and otherwise, that their future usefulness is assured. The immediate need is for trained teachers, investigators, and administrators, and in response to this, graduate work in agriculture has developed with amazing rapidity during recent years, though in certain colleges it is still handicapped by lack of funds and accommodation. At present the full agricultural course extends over four years, but there is a suggestion to extend this to five in some cases for the purpose of specialised training. In many colleges the curricula have been steadily changed in order to keep abreast of the modern requirements of agricultural education, though there are still some in which the work is too largely restricted in a narrowed outlook.

The field of work covered is very wide, ranging over at least a dozen branches, which, however, are not rigidly separated but dovetail into one another to some extent. All branches have developed from small beginnings, shaping themselves according to the needs of the time, with the result that some subjects which were originally an integral part of one branch are now dealt with more fully and adequately by others. Agronomy was initially defined as covering that part of the general field of agriculture devoted to climate, soils, fertilisers, and farm crops, but it now tends to deal with the more fundamental and far-reaching problems of soil physics and chemistry, plant physiology, and plant genetics. It is claimed that the instruction in agronomy has had much to do with securing the improved crop production of the United States in recent years. Horticulture has almost always had a separate existence in the colleges, but with the growth of various interests, certain branches have developed until now they are treated independently, pomology and vegetable gardening being notable examples. With the better recognition of the importance of the forests to the nation, the instruction of forestry has advanced from exclusive concern with questions of afforestation to consideration of the vital problems of the proper protection, management, and perpetuation of existing stands of timber. The land grant colleges recognise their opportunity and responsibility to train the leaders with the necessary technique and with the broad outlook which will enable them to develop sound public policies of dealing with the forests and to establish right standards of practice. The general scheme of education keeps in view both the scientific and practical aspects of agriculture, and endeavours to emphasize the entire interdependence of the two. In addition to the branches already mentioned, special sections are devoted to soils and fertilizers, plant pathology, entomology, animal, dairy, and poultry husbandry, veterinary education, and agricultural engineering.

It is recognised that the four-year college course is not sufficient to supply the demand for trained workers on the land, partly because so large a percentage of graduates draft off into other occupations, as teachers, county agents, scientific workers, &c., and partly because a large proportion of those intending to farm cannot afford the time or money for a full college training. To meet the needs of the latter class various types of short courses have been developed covering the various sections of the community concerned. The older boys and girls are catered for by special agricultural schools, farmers are provided with short courses extending over a few weeks only, at the slackest times of the year, and short schools are held for training specialists in such subjects as dairying, cotton culture, and ice-cream manufacture. In addition, courses in agriculture and horticulture are run for one, two or three years, primarily for young men and women who intend to make farming their life work. Many problems have arisen in the development of these short courses, and special endeavours are made to solve them in such a way as to render the course an integral and valuable part of the whole educational scheme.

During recent years a very marked development has taken place with regard to the professional training of teachers in agriculture. Special legislation has provided grants from Federal funds for the purpose, on the condition that equal sums are found by the States participating. The expenditure in this respect increased from 121,244 dollars in 1918 to 651,792 dollars in 1921, the growth of the work being so rapid that it was difficult for the land grant colleges to secure adequately prepared instructors for the purpose. Still more recently a demand has developed for courses in education designed to meet the needs of college instructors, and there seems little doubt that this part of the work will increase in relative importance. The same may be said of the agricultural extension work, which has steadily increased until in 1921 more than 18 million dollars were expended thereon, directly aiding the improvement of the farm and home practice of more than 2 million workers directly connected with the farm, the whole of the extension work in 1920 costing 75 cents for each 1,000 dollars of gross returns from agricultural production in the United States.

SWARMS OF LOCUSTS.

IN an article entitled Flying Mountains of Locusts in the *Scientific Monthly*, April, 1925, mention is made of some of the recorded swarms of locusts in different parts of the world and figures are given to indicate the size of the swarms.

Reference is made to the eighth plague of Egypt in the following quotation. "They covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees which the hail had left; and there remained not any green thing in the trees, or in the herbs of the field, through all the land of Egypt."

The swarm of 25th November, 1889, which migrated from Africa to Arabia across the Red Sea, is characterized as "Twenty trillion grasshoppers; forty-four million tons of them; covering an area of 2,280 square miles; all day long passing a given point."

A swarm which passed over Pretoria, 25th May, 1891, is said to have filled 12 cubic miles of space in the air. In 1866, Algeria was invaded by a swarm of locusts, estimated to weigh 50,000 tons and to have caused by their devastations, a famine which resulted in the death of 200,000 persons. On the island of Cyprus, in 1883, the egg masses laid by the females in a swarm of locusts was estimated at a weight of 4,000 tons.

The invasion of the State of Kansas in 1876 by the Rocky Mountain Locust was an example of one of the world's great insect migrations. The effects on the country side were the same as those quoted in the Bible for Egypt, and, in addition, the grasshoppers which were crushed on the railway lines, greased the rails so that the trains could not run.

It is stated that recently 18 tons of dried locusts were shipped from South Africa to Holland for the extraction of the oil, for use in airplane engines. This oil is said to retain its liquidity at very high altitudes. The figures given for the numbers of these insects and the size of the swarms are amazing, and the damage done by them is enormous. The almost instantaneous transformation of the green vegetation of a whole country side into living grasshoppers is one of the startling occurrences in nature.

The Grasshopper Glacier a few miles north of Yellowstone Park is said to take its name from the enormous number of these insects imbedded in the ice of the glacier. Presumably great swarms of them attempting to cross the glacier have been chilled and trapped, and subsequent falls of snow have incorporated their bodies into the ice.

The subscription to *Tropical Agriculture* is six shillings per annum, post free, to all countries within the British Empire or seven shillings, post free, to all other countries. Subscriptions can commence at any time during the year.

THE PINK BOLLWORM.

In the United States.

FROM the report of the Federal Horticultural Board for the year ended 30th June, 1925, it appears that the control of the pink bollworm in the United States continues to be very satisfactory. No new areas of infestation have developed and this pest is still confined, so far as is known, to certain areas in Western Texas and New Mexico which on account of proximity to or contact with infested areas in Mexico must continue to be subject to re-infestation at least until Mexico can be induced to co-operate in some project for its control. Noteworthy success has attended the eradication efforts in eastern Texas and Louisiana where most of the localities appear to have been freed from the pest.

The success attending the campaign in these districts is deemed to be specially encouraging giving as it does an indication that similar success may be attained at any time when new areas of infestation may develop by introductions of the pest from Mexico. Experiments are being continued with machines for heating cotton seed for the purpose of disinfecting it. It is hoped to develop a type of heating machine fully efficient for destroying the pink bollworm in cotton seed and suitable for work under the conditions at the gins.

The technical studies of the pink bollworm which have been carried out in the Laguna district of Mexico for a considerable series of years have been largely discontinued. It is, however, deemed very necessary and useful to keep more or less observation on this and other districts in Mexico invaded by the pink bollworm, to determine any new phases of the situation which may develop and, incidentally, the variation in infestation from year to year and the benefits of any control measures which may be undertaken there based on the studies which have been made in previous years and which are being to some extent adopted by growers. It is proposed to undertake, however, a supplemental series of investigations in the Big Bend district in Texas, where the pink bollworm has become so thoroughly established as to make such studies desirable and possible. Among other subjects, this work will deal with the conditions under which local variations in the abundance of the insect occur, the testing of certain poisons suggested by the preliminary work in Mexico, and methods of fumigating cotton lint and seed.

WHEN Mr. T. B. Cassels, the Trade Commissioner for British Guiana in London, recently broadcasted a talk about the Colony from 2LO, he offered two prizes for the best essays on British Guiana. Some 350 essays were sent in, and the first prize of £10 was awarded to Mr. Edmund Hill, 53, Richmond Rd., Bayswater, and the second prize of £5 was won by Miss Irvine Aberdeen, 7, Palewell Park, East Sheen.

IS COMMERCIAL SYNTHETIC RUBBER PROBABLE?

UNDER this title, Mr. L. E. Weber, in *Industrial and Engineering Chemistry*, April, 1926, p. 404, discusses the possible future of synthetic rubber. Because of the recent incease in price of natural rubber, renewed interest in synthetic rubber manufacture has been keenly aroused. During the stress of war conditions, a substance designated synthetic rubber was actually produced in the United States at the rate of some forty tons per month, but it was satisfactory only for making hard rubber articles. Its properties rendered it of no value in the manufacture of soft goods, because its vulcanized product was lacking in elasticity and stability. These deficiencies were partly remedied by adding elasticators, but even then the product could in no sense be regarded as a good rubber substitute.

The manufacture of synthetic rubber involves two distinct operations; (1) the preparation of a parent hydrocarbon, and (2) polymerization of the hydrocarbon. Isoprene and methyl-isoprene have been mainly employed as parent hydrocarbons.

(1).—*Preparation of Parent Hydrocarbons.*

Isoprene may be manufactured from either turpentine, starch, coal-tar or petroleum. Turpentine is too scarce and costly to be a suitable raw material. The use of starch involves too many complex intermediate preparations; (fermentation into iso-amyl alcohol, chlorination into iso-amyl dichloride, and decomposition into isoprene). The use of coal-tar involves even greater complications; (hydrogenation of para-cresol to methyl-cyclohexanol, oxidation to methyl-adipic acid, conversion into methyl-adipic diamide, methylation into methyl-tethramethylene-diamine, and deammonification into isoprene). Recent experiments by American chemists have shown, however, that petroleum is the most suitable raw material, its conversion into isoprene being much cheaper than the syntheses above described.

Methyl-isoprene is more readily synthesizable than isoprene, and has been increasingly favoured as parent hydrocarbon for artificial rubber manufacture. The starting point is acetone, which can nowadays be produced cheaply from coal, *via* calcium cyanamide or carbide, acetylene, acetaldehyde or ethylene, ethyl alcohol and acetic acid. (Ethyl alcohol can also be produced from cellulosic materials, from molasses, or from water gas, *via* methyl alcohol (see *this Journal*, September, 1925, II, 9, p, 192). In making methyl-isoprene from acetone, the first step is its reduction to pinacone by the use of aluminium and caustic soda. Pinacone yields methyl-isoprene on distillation under pressure.

Needless to say, when it is proposed to synthesize a substance whose consumption is several thousands of tons per annum, the question of the supply of a suitable cheap raw material is of paramount importance. If coal or petroleum will satisfy all the requirements of the synthetic chemist, it is possible that artificial rubber may one day be put on the market at as cheap a price as that of the natural product.

(2).—*Polymerization of parent hydrocarbon.*

Isoprene and methyl-isoprene can be polymerized merely by allowing them to remain at ordinary temperature, preferably in the presence of hydrochloric acid. Autopolymerization at 60°C., however, gives better and quicker results, and this is the method that has found widest practical application. Isoprene or methyl-isoprene is placed in steel drums and allowed to stand at 60°C. for four to six months.

Comparison between Synthetic and Natural Rubbers.

To be of any value in industry, raw rubber must possess high plasticity, and latent elasticity and abrasive resistance, which are developed on vulcanization. So far, all synthetic soft rubber products have been deficient in elasticity and abrasive resistance, and are comparable only with the lowest grades of vulcanized plantation rubber. Moreover, they possess very undesirable chemical instability, aging rapidly into brittle, worthless residues. The factors that confer plasticity on rubber are not yet definitely known. No satisfactory means of conferring plasticity, even on *natural* rubber that is deficient in this property, have yet been devised, so that the difficult problem of remedying the deficiency in *synthetic* rubber would appear to be one of major magnitude. Attempts to improve synthetic rubber by incorporating substances called elasticators into it, have not attained much success.

It has been suggested that plasticity in natural raw rubber is due to the fact that crude rubber is a two-phase system. During mastication in the mixing mill, the outer coatings of the rubber globules may become dispersed in the liberated inner liquid phase, thus furnishing an intimate mixture between rubber hydrocarbon and the natural accelerators which the outer coatings are known to contain. Perhaps, therefore, the synthetic chemist may merely have to add suitable accelerators to artificial rubber in order the more nearly to imitate the composition of the natural product. Nevertheless it is realised that the problem is probably not so simple as this, because the inner structure of the rubber hydrocarbon doubtless plays an important part in conferring plasticity on raw rubber. Indeed, many of the characteristic properties of colloidal substances (raw rubber is a typical colloid), are known to be due mainly to their inner structure or molecular architecture. Thus the actual *state* of polymerization may be the ultimate factor deciding the properties of synthesized rubber, and it may prove difficult to induce a proper state of polymerization by artificial procedures,

Finally, the mode of aggregation of discrete rubber particles into systems that ramify throughout a rubber mass may be just as important in deciding plasticity as internal structure and colloidal aggregation is difficult to control.

According to Mr. Weber, "the dispassionate "weighing of the facts prompts the conclusion "that the synthesist has yet to devote much "labour and effort before he can lay claim to "having reached his goal, and under these "conditions, the creation of an impression that "synthetic rubber, if not actually near at hand, "is at least within reach, is unfortunate, because "it arouses immediate hopes which cannot be "fulfilled."

Economic considerations.

In conclusion, let us grant that the day will arrive when the synthesist has accomplished what is still lacking, and has produced from some cheap raw material a synthetic rubber equal in quality to the natural product. It is only then, writes Mr. Weber, that the battle will commence. The synthesist's adversary will be the plant biologist, an investigator who has not yet been much in evidence in the rubber industry. Whatever be the present cost of production of plantation rubber, there is no doubt that it could be reduced if the output of rubber per tree were materially increased. Considering the success of the plant biologist in increasing the productivity of other crops, it would appear reasonable to assume that his activities may enable the plantation rubber industry to conduct a bitter economic war against any intruder, without affecting seriously its own prosperity.

The rubber synthetic chemist may point with assurance to the fate of the natural indigo industry, as an example of what he believes must also befall the natural rubber industry, but it must be remembered that the natural indigo industry was not so highly organised as the present rubber industry, nor was it controlled by men who understood so thoroughly the advantages and potentialities of scientific research. To assume that the rubber planter will not avail himself of every scientific weapon at his command, is to ignore the history of the plantation industry during the last decade.

F. HARDY.

AGRICULTURAL NOTES.

COMPILED BY THE COLLEGE DEPARTMENT OF AGRICULTURE.

Some Results with Cotton Cultivation.

DURING the season just over, the College Department of Agriculture had an area of about three-quarters of an acre under Sea Island cotton on College lands at St. Augustine. The bulk of this was grown from Montserrat seed, planted on the last day of October, 1925. The field had hitherto been in abandoned savannah and scrub and was recognised as low in fertility, the soil being of a light silty nature. It was broken with the plough in late July, 1925. Nothing further could be done until September when it was ploughed again in the opposite direction, harrowed and banked, pen manure at the rate of ten tons per acre being worked in. Shallow drains were dug fifty feet apart. At the same time, a thick pigeon pea windbreak was sown. The banks were all made four feet apart and the field laid out in plots to enable one of our post-graduate students to carry out special work on spacing, growth development, flowering and bolling studies, &c.

It was thought desirable to adopt the bank method as previous experience had shown that where there was a likelihood of considerable observation work being done, banking would reduce the damage to plants from trampling, &c. The banks were first formed by the plough, then levelled up by hand labour. Care was taken to avoid the high, narrow type of bank which dries out easily and is prejudicial to a crop like cotton. The seed on the whole germinated well, though somewhat unevenly; it would probably have been worse on the flat, land of this type taking some time before optimum tilth can be established. A minimum of after-cultivation was practised. When the plants had made sufficient growth, two weedings with light moulding up were given. Thereafter, they were not disturbed except for measurements and observations and during the search for pests and diseases which were regularly made. By mid-April 1926, practically the whole crop had been removed.

Of the six spacings adopted, the widest—24 in.—gave the lowest yield, and the closest—12 in.—gave the highest. These yields were at the rate of 1,210 lb. and 1,575 lb. seed cotton per acre respectively, the difference being statistically significant. The yields from the intermediate spacings were in all cases significantly better than from 24 in., but showed insignificant differences between themselves. Nor was there any marked difference between the yield obtained by direct planting at 12 in., and that obtained by continuous planting and subsequent thinning out to 12 in., on the appearance of the first flower bud.

The outstanding feature is the high yield obtained from the close spacing. Complete results on all the points studied will be available in due course, but in the meantime it is of practical interest to note that these yields were obtained over a total period of approximately five and a half months, the rainfall for the first two months of growth being 12.05 in. and for the remainder of the period 2.29 in. It may fairly be claimed that the crop has been economically produced from the point of view of both plant and planter, due, it would appear to a combination of factors, of which seed strain, late planting (for dry season maturity) and close spacing are not the least important.

FROGHOPPER BLIGHT.

By C. L. Withycombe.

(*Concluded.*)

Froghopper blight is by no means the only case of insect attack being governed by varietal and environmental factors. Many pages could be filled with instances of this nature. Varietal resistance, especially, is too well known to require any comment. The immunity of wild American vine stocks to the grape phylloxera, of certain apple stocks to woolly aphis, and of some varieties of wheat to Hessian fly, are quite familiar examples which are made use of in practice.

There is also the effect of environmental conditions on the plant, influencing its susceptibility to insect attack. As long ago as 1901, Lefroy (3) pointed out the importance of favourable environmental conditions to the plant as an insurance against insect attack and he especially emphasised this in the case of scale insects upon limes, which he said were very much more likely to become infected when grown under conditions of insufficient moisture than when under good conditions. In similar manner he refers to thrips (*Selenothrips rubrocinctus*) upon cacao. Again, Elot (4) emphasises the importance of good cultural methods in diminishing liability to attack by the latter insect. Many others have expressed similar opinions, and we now have a considerable mass of evidence all tending to support an hypothesis very much the same as that enunciated for froghopper, namely, that under conditions of actual or physiological water shortage cacao trees are more liable to suffer from thrips attack than when good conditions obtain. Thrips usually appear in drier weather, or on the edges of plantations where the atmosphere is drier, or in exposed places with insufficient shade. Again, they may be associated with trees in waterlogged condition, on heavy clays in bad tilth, &c. Somewhat similar remarks might be made of coffee thrips (*Diarthrothrips coffeae*), of sugar-cane thrips (*Heliothrips striatopterus*) and others.

The subject of plant immunity to insect and other diseases is still in its infancy, but we are slowly accumulating data which will form the basis of insect control in the future upon truly scientific lines, with a gradual elimination of the palliative measures of the past.

There is, however, still another aspect of the froghopper blight to be considered. It must be admitted that in several estates in Trinidad there are soils of an extremely difficult nature, which, even with continued careful treatment, will require many years to improve substantially. Upon such soils as these, canes may for a long time be subject to serious blight. Further, there are certain adverse conditions against which provision can hardly be made, *e.g.*: an unusually dry Indian summer or a local accumulation of stagnant water in a field of difficult contour. While recognising, therefore, the absolute need for improved cultural conditions as the only permanent remedy a temporary palliative is an obvious desideratum.

The eggs of the froghopper are laid in cane trash, in moist ground, or in any soft, damp material. They can, of course, be destroyed by removing or destroying this material and one excellent method where practicable is that recommended in William's report p. 139 (2), namely the removal of trash to the cattle pens and its subsequent return to the fields as manure. The eggs and hatching nymphs are destroyed by the trampling of the animals and by the heat of fermentation, while egg parasites which can fly may often find their way back to the fields. The method, however, can rarely be put into practice.

The egg hatches to a nymph which lives upon the roots of the cane and other grasses, sucking the sap and covering itself with a protective froth. This stage is by no means easy to attack. Under conditions of excess moisture, or especially in compacted soils, a number of nymphs may form their froth masses at or near the surface of the ground. The number of froth masses visible is, however, no reliable indication of the total number of nymphs on the roots; it is, as has been said, a function of moisture and soil texture. Even when present at the surface the nymphs are not readily destroyed. The froth is impermeable to insecticides unless these can dissolve in, and readily penetrate the froth. Also the insecticides must be contact poisons. A number of chemicals have been found to answer these requirements, but there is a distinct advantage on the side of dusts in the matter of application, and here calcium cyanide excels. Few nymphs need be present at the surface at any one time, however, and the efficacy of the treatment is thus reduced. Repeated applications may become necessary. To attack the nymphs below ground might be attempted by the injection of soil fumigants although here again the froth of the nymph is found to be almost impenetrable to all ordinary fumigants such as carbon bisulphide, naphthaline, paradichlorobenzene, &c. The low death rate of nymphs does not seem to make the process worth while. Again calcium cyanide promises better but there are several disadvantages in the field. In respect of liquid insecticides the writer has obtained success with certain pyridine mixtures which can be watered into the soil. A mixture of pyridine and soap is capable of emulsifying from one to five times its volume of carbon tetrachloride, carbon bisulphide, dichlorobenzene or other fumigant and such a mixture can be diluted with water in any proportions. This forms a valuable contact insecticide which also satisfies requirements by penetrating the froth. An emulsion with

3. *West Indian Bulletin II. p.* 330.
4. *West Indian Bulletin II. p.* 298.

2. Memoir No. 1, Dept. Agric. Trinidad & Tobago, 1921, 170 p.p.

carbon tetrachloride is more particularly efficacious. There are, however, many practical difficulties to be overcome in all these soil treatment methods and experiments on a large scale must be conducted before it will be possible to say whether or not any of them can be made profitable.

The adult froghopper lives in the hearts of the canes by day and comes out to feed upon the leaves at dusk. It is attracted to lights and can thus be trapped, but females are rarely caught by this method and they constitute the more important sex.

Spraying insecticides is out of the question in Trinidad although it might be possible in a country such as British Guiana where dykes with water are present on all sides. Here we are therefore obliged to look for an insecticidal dust. The dust again has to be a contact insecticide because the froghopper being a bug pierces and sucks the juices of the cane leaf. A stomach poison distributed over the surface of the leaves is utterly useless, because the leaf itself is not eaten. Again, many contact dusts are of small value because the spiracles or breathing pores of the froghopper open on the underside of the body and are so protected from contact while the back is roofed over by the thickened forewings. The required dust should therefore evolve poisonous fumes and so act directly as a respiratory poison. Further, it must not scorch the leaves or otherwise damage the canes. The conditions imposed are by no means easy to satisfy and a considerable range of poisons has been tested with only moderate success. Several dusts, however, are now under final consideration and the difficulties do not seem to be insurmountable.

When the suitable dust has been obtained there is only one method of distribution which is likely to be at all effective or economical in practice: that method is by means of an aeroplane. Insecticide dusting from aeroplanes is no longer to be regarded as a fantastic ideal; it is an accomplished fact. Certain pioneer work has already been noted in these pages ([5], [6]), and now we have reports of success from many quarters; in the United States the dusting of cotton thus is no longer a novelty, in Germany forests have been successfully treated against defoliating caterpillars, while in Russia it appears as though a practical solution of the locust problem has at last been found.

Contact insecticides have apparently not yet been applied in this manner and we have to break new ground in Trinidad. There are obvious difficulties, but they can probably be overcome. The writer is confident that success can be achieved after some trials and adaptations to our peculiar conditions.

5. *Trop. Agric. I* 1924, *p.* 116.
6. *Trop. Agric. II* 1925 *p.* 99.

Subscriptions to *Tropical Agriculture* can commence at any time during the year.

NITROGENOUS FERTILIZERS.

The Relative Value of Nitrate Nitrogen and Ammonia Nitrogen in Fertilizers.

PROFESSOR F. HARDY, M.A.

IT was at one time widely believed that the only form of nitrogen directly assimilable by crop plants was nitrate nitrogen, and that, when ammonium salts, such as ammonium sulphate, were used as nitrogenous fertilizer, it was necessary that they first be transformed within the soil, by micro-organic agency, into nitrate. Evidence, however, has accumulated during the past thirty years or so, that this belief is not completely correct. Thus, in 1909, Hutchinson and Millar at Rothamsted showed conclusively by carefully controlled experiments, that *wheat* and *peas* could assimilate nitrogen from ammonium salts under conditions which exclude even the possibility of the previous transformation of these salts into nitrate. Later, in 1910, Pantanelli and Severini, working in Italy, demonstrated that the same conclusion applied also to *rice*, and *linseed*, and Prianishnkov, in Russia, in 1923, further extended this list of crop plants to include *field beans* and *maize*. These results have, in most cases, been amply confirmed by other workers.

McGeorge, in Hawaii, experimented similarly with *sugar-cane* in 1923, in an attempt to discover whether or no this plant also can directly utilize ammonia nitrogen. He obtained decidedly negative results. In his ammonium-salt cultures, the cane plants sent out strong shoots, but practically no roots developed, so that, after a few weeks, the plants withered and died. On the other hand, nitrate cultures showed excellent growth in both root and shoot. McGeorge therefore concluded that sugar-cane, unlike the plant-species so far mentioned, cannot grow without nitrate nitrogen. If ammonium salts are used as fertilizer for sugar-cane, some time must elapse before they are changed into the suitable nitrate form by specific soil organisms, and this result can only happen if the soil conditions are such that active nitrification of ammonia can proceed at a sufficiently high rate to keep up with the rate of nitrate absorption by the plant.

The most recent work on the nitrogen fertilizer problem is that carried out in Hawaii on *pine-apples* by Stewart, Thomas and Horner (*Soil Science*, 1925, Sept., XX, 3, p. 227). These investigators employed the culture-solution method which had yielded such definite evidence in the other studies above-described. Their results led them to conclude that the pine-apple plant, unlike sugar-cane, is able to assimilate *all* its nitrogen in the form of ammonium, but that, under field conditions, it is probable that pine-apples utilize both nitrates and ammonium salts indiscriminately. Since pine-apples appear to thrive well in soils possessing considerable degree of acidity, it is evident that there would be no objection to the use of ammonium sulphate as nitrogenous fertilizer for pine-apples.

ANIMAL NUTRITION.

THE following information on this subject prepared from a recent report in *Science Progress* by Professor Woodman of the School of Agriculture, Cambridge, *The Field* and other sources, including the writer's own notes may be of interest to livestock owners :—

Significance of vitamins : Much of the early research had been confined to small animals—rats, guinea pigs and pigeons, which showed themselves susceptible to vitamin deficiency. Since about 1915 attention has been given to the requirements of cattle, goats, sheep and horses. It was found that cattle and horses were not so susceptible as smaller animals, while it appeared that the pig — swine husbandry proceeding on more artificial lines—was more likely to suffer from vitamin deficiency than other classes of stock. There also emerged the fact that where the diet was not well balanced in respect to protein and mineral substances, disorders resembling vitamin deficiency were developed. Thus, it is suggested that the early conclusions about vitamin deficiency may, in some cases, have been misleading. Indeed, it has been concluded by Orr of the Rowett Institute, Aberdeen, that where home-grown foods are used in *properly balanced* rations, farm animals are not likely to suffer from vitamin deficiency. Unfortunately, in the tropics, the question of properly balanced rations is little understood by the average livestock owner; under ordinary circumstances, however, there is a fair supply of green food, rich in vitamins, which is a great asset. In this connection, it may be noted that the addition of cod-liver oil (rich in vitamin A) to the rations of winter-fed animals—dairy cattle in particular—has been attended with very marked results from the point of view of the nutritive value of the milk, which without the addition of cod-liver oil to the winter rations may contain only one-tenth of the growth-promoting factor found in the milk of grass-fed cows. The use of oils deficient in this factor does not produce the required result. It is stated that from one to eight ounces of cod-liver oil per day fed to milking cows causes no fishy taint in the milk or butter fat, but excessive doses may result in a lowering of the percentage of butter fat.

Importance of minerals : It was reported from the Union of South Africa some time ago that a deficiency of phosphorus in the diet, notably of range cattle, had been accompanied by certain diseases characterised by depraved appetite of the animals affected and that the feeding of bone meal had been found profitable in all areas where the soil and pastures were known to be deficient in phosphorus, which with calcium is a very important factor in the growth of young stock and in the milk yield of cattle. Some idea of this may be obtained from the fact that a gallon of cow's milk contains, on the average, .24 oz. of lime and .32 oz. of phosphoric acid. In recent years, the sheep population of the Falkland Islands has fallen from 800,000 to 700,000 and it was becoming increasingly difficult to rear lambs. Samples of pasture grass submitted to the Rowett Institute, Aberdeen, by the Governor of the Islands, have been analysed and found to contain less than one-third of the lime contained in he grass of British cultivated pastures, and even less than in the poor pastures rejected for sheep in Britain. Investigations have shown that the grass of the best grazing lands in England, notably those on which blood stock is reared. contain as much as 2.17 per cent of lime and 1.15 per cent. of phosphates, or approximately 21 parts of lime to every 5 parts on certain hill pastures examined. From time to time, attempts at stock rearing in many parts of the tropics have ended in disaster from causes seemingly unexplainable, and to what extent lack of sufficient mineral food has been responsible for such failures would seem to be a problem worthy of careful study. In any case, speaking generally, pastures and grazing grounds in the tropics receive little or no attention. On the other hand, it has been shown that where conditions justify treatment of such lands with mineral-supplying materials does result in improvement of the quality of he herbage thereon. Again, it is not sufficiently recognised in the tropics that leguminous forage and hays have a high mineral value and from this standpoint alone are worth cultivating as food for livestock, even though in some cases they may not yield as much bulky feed as many of the grasses. In this connection the recognition given to the pigeon pea (*Cajanus indicus*) in Hawaii is worthy of the careful attention of all stockmen in localities where this crop can be grown. Indeed, it would appear to be a very valuable substitute for the highly prized lucerne of more temperate regions.

Scientific rationing : From Cambridge, distinct advances on the old feeding-standard systems are reported. These are usually considered faulty on account of their lack of elasticity and the difficulty of modifying them to meet varying requirements. As a result of much experimental work, Professor Wood has recently put forward a basis for calculating the ration required to produce any desired rate of live weight increase for an animal of any given weight, age and condition. The starch equivalent to produce 1 lb. increase has been worked out and also a figure based on the usual appetite of an animal as regards dry matter consumption. The system takes into account requirements for both maintenance and production. The following is an example from the tables for a beef animal (forward store) 18 months old :

Maintenance ration for 8 cwt. animal	5.5 lb. starch equivalent.
Production ration for 2 lb. increase per day	4.0 lb. starch equivalent.
Total ration	9.5 lb. starch equivalent.

This is supplied in a ration within the capacity of the animal's appetite which is about 20.5 lb. of dry matter per day. For milk production, the ration is 2.25 lb. starch equivalent per gallon of milk, to be increased if the milk contains more than 3.5 per cent. butter fat. The method is also applicable to sheep and pigs, but not yet workable in the case of young animals.

Influence of cooking on feeding stuffs: This is a point frequently discussed and a great deal of uncertainty has been expressed about its value. Extensive trials with maize for pigs have led to the conclusion that cooking is an uneconomical procedure, the gain being small and not sufficient to compensate for the trouble and expense; coupled with that is the risk of such material turning sour if kept too long. On the other hand, the feeding of dry, crushed grain is not recommended on account of the large expenditure of energy by the animal during mastication, which in turn diminishes the productive energy of the feeding-stuff. Soaking the grain thoroughly before feeding gets over this difficulty.

J. SYDNEY DASH.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

"Adco" Manure.

We have received a very interesting pamphlet, recently issued by Adco Limited of Harpenden, England, in which methods are described for converting waste cellulosic materials into valuable synthetic farmyard manure. The subject matter is fully illustrated by tables of chemical analyses, and by photographic reproductions taken in many parts of the world where "Adco" manure is being made. Full costs are stated and adequate directions are given for making the manure from all sorts of vegetable waste.

The following are the directions for preparing Adco synthetic manure from 30 tons of sugar cane trash. Arrange the loose trash on a square of hard ground about 17 yards side; the nearer to water and the more sheltered from wind the better. When 3 tons are in position, start watering through a rose or any convenient form of sprayer. When the trash is well wetted, scatter on 4 cwt. of all Adco mixture as evenly as possible. Sprinkle with a very little water so as just to clean the top of the trash layer. Spread another 3 tons of trash over the first, wet and distribute 4 cwt. of Adco mixture as before. Continue this until the whole 30 tons of trash is in position and partly wetted. About 600 gallons of water should be distributed on each layer of trash. The last layer of Adco mixture should be covered with a few inches of trash, and well wetted. In a few days the stack should heat to at least 80°F. in the centre; under certain conditions it may be as long as four weeks before the maximum temperature (180°F.) is developed. As soon as the temperature has risen to 80°F. apply 6,000 gallons of water and repeat this at intervals of not less than three days until the whole stack has received over 24,000 gallons of water in all. In arranging the trash, the top of the stack should be as level as possible, and not more than 8 ft. high when all the trash is in position and partly wetted. The object to be aimed at is the exact opposite of that in view when building up a stack of corn. Water is to be taken up and held in one case, and to be kept out in the other. The top and sides will inevitably dry up, especially if the stacks are exposed to the wind. To correct this, a small quantity of water may be added from time to time when necessary. The manure should be ready in from four to six months from the start, according to the "shortness" required. The heap may be turned and wetted, if necessary to accelerate rotting.

Feeding Value of Cotton Seed.

At the seventy-first meeting of the American Chemical Society at Tulsa, Oklahoma, during early April of this year (1926), a symposium on cotton and its products was held by the Division of Agricultural and Food Chemistry. Seventeen papers were presented, and of these five were read by their authors. A paper on gossypol and cottonseed meal poisoning produced considerable discussion and established the opinion that small quantities of gossypol are not poisonous, whereas larger doses are distinctly toxic, and that raw cotton seeds are more poisonous than seeds that have been beated or treated with solvents to remove oil. Another paper on the feeding value of cotton seed meal showed that the stuff contains a high percentage of phosphorus, but a rather low percentage of calcium and sodium. When fed to animals, it therefore needs balancing by mineral additions in order to render it really nutritive. The author of a paper on the proteins of cotton seed stated that before long, these proteins will be extracted and used for human consumption. — *Indus. Engin. Chem., News Edition, 20th Ap.*, 1926.

NOTE.

The last point mentioned in the foregoing summary is interesting in that it suggests a further possible use for limeseed fatty oil and for oils of other Citrus seeds. Limeseed oil has been shown by Collens and Warneford of the Leeward Islands Laboratory, B.W.I., to contain even a greater amount of crude protein than cottonseed, namely, 30·5 per cent. against 23·7 per cent. in a sample of Barbados cotton seed meal.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

TROPICAL WORLD NOTES.

Rhodesia.

Rhodesia is a young man's country and an ideal land for those who are fond of pioneering conditions. These points were emphasised by the Hon. J. W. Downie, Minister of Lands and Agriculture, during an interview at Johannesburg.

Describing the colony's land settlement scheme Mr. Downie said the Government welcomed settlers with a capital of £900 to £1,500. The Government, in conjunction with the Overseas Settlement Committee, is providing an additional £600 for farmer settlers on loan towards permanent improvements. The procedure at present is that a settler after being accepted goes to a Rhodesian farmer for a period of twelve months' tuition, the Government paying the farmer £5 a month for the board of the pupil.

On the completion of the tuition the settler is given a grant of land for which he does not pay anything for the first three years, provided he does a minimum amount of work on the property, and in that respect the Government helps him by making him a grant up to £600 for permanent improvements such as erecting dipping tanks, providing water supplies, building a residence, &c. At the end of three years the settler begins to repay the Government the advances made plus the price of the farm. This is repayable in forty equal instalments. The Government is working on the principle of safety first, and this scheme is being tested out on a maximum number of 100 settlers per year.—*The African World.*

Gold Coast.

Sir Frederick Guggisberg in opening the Legislatve Council of the Gold Coast, at Accra on 22nd February, stated that both in tonnage and value the Colony's trade had been better during the past year than at any previous time in the history of the Colony. In view of the considerable surplus of revenue over expenditure the *ad valorem* duties had been reduced from 20 to 10 per cent. Owing to the intense drought experienced last year followed by exceptionally heavy rains the exports of cacao amounted to 213,000 tons, a quantity somewhat less than that for 1924. Progress has been made in establishing subsidiary industries such as sisal, copra, fruit and lime juice, and in the revival of the palm-oil trade. The cotton industry is being developed in the northern territories and the mandated territory of Togo on lines similar to those adopted in Northern Nigeria. Prospects appear promising. The mileage of motor roads is now 4,734 miles, an increase of no less than 3,434 miles since the termination of the war. With the increase of road and rail facilities it is anticipated that greater crops of cacao will in future be available for export.

Philippine Islands.

Sugar exports from the Philippine Islands in 1925 were 50 per cent. larger than in 1924, according to figures reported by Warner, Barnes and Company of Manila which show total exports last year of 535,822 long tons against 355,444 tons the year previous. The 1925 total was made up of 455,842 tons of centrifugal sugars and 79,980 tons of muscovados.

Exports to the United States increased roundly 157,000 tons and there was a gain of nearly 23,000 tons in exports to China. The comparative figures for the two years are given as follows, in long tons:

	1925.	1924.
To United States–		
Atlantic	373,291	254,353
Pacific	82,556	44,652
	455,847	299,005
China	66,161	43,464
Japan	13,814	12,975
Total	535,822	355,444

Export shipments from Manila totalled 143,467 tons in 1925 against 89,431 in 1924; from Iloilo, 227,818 tons against 167,657; Pulupandan, 107,420 against 65,350; San Carlos, 24,272 against 15,660; Bais, 24,625 against 11,970; Mangarin, 5,496 against 4,457; Cebu, 2,724 against 919.

Exports in December, 1925, were 46,786 tons, of which 40,558 tons came to the United States. In December, 1924, they were 33,569 tons, including 31,892 tons to the United States.—*Facts About Sugar.*

British Guiana.

As a result of the favourable recommendation of a committee appointed last May to go into the matter, there has been created in British Guiana a Colonization and Development Board. The Board will be composed of the Colonial Secretary (Chairman) the Director of Science and Agriculture (Deputy Chairman), the Commissioner of Lands and Mines, the Immigration Agent General, the Conservator of Forests, three Elected Members of the Combined Court, one representative of the Chamber of Commerce, one representative of the Royal Agricultural and Commercial Society two representatives of the Sugar Planters' Association, and one representative of the Farmers' Conference. One object of this board is to deal directly with all matters relative to the development of the natural resources of the Colony, pursuing a strong progressive policy, and thereby forming and constituting an advisory board to the Government. The board is also to deal with all matters concerned in, not only Indian Immigration, but also the colonization of the country.

West Africa.

Sleeping sickness is prevalent in the Cameroon district of West Africa. Reports received by the Society of Tropical Medicine and Hygiene state that it is particularly bad in the region of the Nyrong River. Over a third of the population as nearly as can be estimated, have been afflicted, with an ensuing mortality of ten per cent. The country has been divided into districts, the better to combat the disease. In the past, say the medical workers in this area, it has been possible to save only those suffering from the first stages when the parasites are only in the blood and lymph, but it is now hoped that those whose brain tissue has been affected can be cured. The society believes that if proper means are employed to give treatment to the natives and to insure hygienic preventative measures it will be possible to eliminate sleeping sickness from this locality. Accordingly it has been recommended to the Ministry of Colonies that arrangements be undertaken whereby such measures can be got under way.—*Science-Supplement.*

The Punjab.

IN the absence of the Viceroy through illness, Sir Malcolm Hailey, Governor of the Punjab, opened the first completed unit of the Great Sutlej Valley Irrigation Scheme. In his address, the Governor pointed out that of 65 million acres of land in the Punjab, 35 million were cultivated, 18½ being commanded by irrigation canals, while 10½ million acres of crops were annually matured by irrigation. The total arable land of the United Kingdom is 14 million acres while that in England is 10½ acres, which is thus almost exactly the same as the acreage on which crops are matured by the Punjab canals. The canals are 19,750 miles in length while the annual value of the crops matured by their water is 58½ crores (almost £44,000,000). The Punjab has spent 24 crores of capital on its canal works and the Government receives thereon an annual net revenue of 4 crores.

West Indies.

Trinidad and other West Indian islands are experiencing rather an unusually dry dry season. In Trinidad the rainfall has been negligible for three and a half months. This condition appears to be correlated with a period of extreme drought which prevails on the northern borders of South America, in British Guiana, Venezuela and Colombia. In British Guiana, a drought of nearly eight months has resulted in a serious reduction in the water supply for the city of Georgetown, and many of the trench and communication canals on the sugar estates are quite dry. Reports from British Colombia are to the effect that the extreme low water in the Magdalena river has made it impossible to get agricultural produce out to the coast, and that the country is suffering in consequence of the interruptions in its communications.

A Pacific Cable Board telegram dated 3rd May, states that, "the severe drought from which British Guiana has been suffering for the past eight months appears to have been broken, heavy rains having fallen throughout the Colony for the past three days."

Jamaica.

Sir Edward Stubbs, Governor-Designate of Jamaica recently attended a meeting of the Jamaica Standing Committee of the West India Committee. The Chairman, Mr. E. A. de Pass, in referring to the problems confronting Jamaica dealt with the urgent need for an independent service of steamships adopted for carrying fruit to the United Kindgom. Such a service was indispensable if the fruit industry was to be developed successfully since, at present, planters have no opportunity of shipping citrus or other fruit. The matter was engaging the attention of the Legislative Council and also the Imperial Economic Committee. He referred to the formation of the Jamaica Producers Association as a most encouraging sign of changing conditions in Jamaica. He emphasised the essential importance of regulating the export trade and preventing the shipment of immature, badly graded and badly packed fruit. At a later stage of the meeting Lord Olivier former Governor of Jamaica expressed satisfaction at the formation of the Association and stated that when he first went out to Jamaica he endeavoured to get a bill passed through the Legislature for the grading, &c., of fruits in the interests especially of the orange and citrus fruit growers. The bill was not then accepted but he hoped that now the people of Jamaica realised the advantages of such a measure.

Mr. Wells Durrant pointed out that in October, on the initiative of the Elected Members, a resolution had been introduced into the Legislative Council to provide for the suitable grading, &c., of fruits, and a committee had been appointed consisting largely of Elected Members to consider the matter. A Bill had actually been drafted dealing with that subject, and as far as he knew it was to be introduced in the present session. If it were passed as drafted, the inspection of fruit for shipment would be compulsory.

Queensland.

The question of successfully carrying fresh pineapples from Queensland to England has been the subject of further experiment. A consignment of 154 cases recently arrived in London by the s.s. *Moreton Bay*, representing the largest shipment which has left the State for England.

The fruit was packed in "Brennan's" patent pineapple crate, which is the invention of a Queensland railway officer, who is also the originator of a new form of butter box. The condition of the pineapples on arrival proved superior to that which obtained in the case of former experiments, and would appear to warrant further trials being made. The "Brennan" patent pineapple crate is considered by the fruit market experts to be a very satisfactory method of packing pineapples.—*The Colonizer.*

Tanganyika.

The following notes on the agricultural development in Tanganyika Territory during 1925, *have been received from Department of Agriculture, Dar es Salaam. These notes have been perpared by Mr. R. W. R. Miller, Senior Agricultural Officer in that Department.*

While steady progress has been maintained in most crops, the year under review has been disappointing. After very extensive educational preparation greatly increased areas were put under cotton, but on account of the unseasonable weather a large proportion of the crop was unable to stand the ravages of insect pests and did not mature. In spite of this set-back the yield of cotton is not likely to be less than that obtained in 1924, and probably a little more. The low price of this commodity, due to a successful crop in America, has discouraged the natives, many of whom have neglected to pick the whole of their seed-cotton. Given plentiful rains at the right time the results of a more rigidly controlled seed distribution and the further instruction supplied by the Department of Agriculture, there should be a remarkable increase in the output of cotton lint from this Territory during 1926.

The time has now come, when after some years of careful trial, our own selected cotton will be planted over a large area in the South-Central districts. This cotton is from selected plants raised in Rufiji District from first quality Uganda cotton, and has given excellent results both in the various plantings to date, and in examination by the Fine Cotton Spinners' Association.

The enhanced value of rubber has induced a number of Europeans and others to turn their attention to the neglected plantations of the former German owners and many estates of the Ceara variety are now being tapped for export.

During the year the work of improving the millet grown by the native from the point of view of resistance to disease and insects both during growth and in storage has, occupied the attention of the Department of Agriculture

The very gratifying improvement in the quantity and quality of the Arabica Coffee grown by the natives round Mt. Kilimanjaro has made its mark in the enhanced prices being paid for this commodity. The natives have formed themselves into local co-operative societies for the purpose of buying implements, sprays, &c., and for combatting the many pests and diseases of this popular crop.

The fruits of the visit of the East African Commission in the latter end of 1924 are only being felt now in the provision of docks, roads and railways, and it is upon these improved transport facilities that the increased exportation of agricultural products depends. To illustrate this, the extension of the cotton fields in the far South-western area is absolutely prohibited by the circumstance that the native can only be paid one penny to three-halfpence a pound for his seed cotton owing to the fact that it costs £50 to get a ton of lint to the port of shipment (Beira through Nyasaland).

Those interested in the Territory will find that the Annual Report for 1924-25 of the Department of Agriculture, records in detail the steady progress of this, our youngest Dependency. It can be obtained from the Crown Agents for the Colonies for two shillings and sixpence.

Union of South Africa.

Interesting figures are given in the Report of the Cost of Living Committee (1925) as to how far the food supply of the Union is produced locally and the extent to which we depend on imported food. It is shown that in the case of maize, maize meal, bacon and ham, butter, cheese, fresh fish, jam, sugar, potatoes, and mutton, South African production accounts, as a rule, for well over 90 per cent. of the consumption. In the case of wheat and canned fruit the proportion of South African products consumed has, on occasion, reached or exceeded 90 per cent., but owing to variations in weather conditions, &c., the proportions show greater fluctuations than in the case of the first named commodities. The imports of beef and mutton come mainly from South-West Africa and Rhodesia.

In discussing the nutritive values of the different foods, the Report states that meat is an excellent but very expensive source of protein. By the substitution of other foodstuffs which are cheaper sources of protein, the needs of the family could be supplied at much less cost. The example of rice is quoted, in which it is pointed out that it is still largely used in South Africa, and might be replaced to some extent by our own cereals, higher in protein fat and mineral matter and at less cost.— *Journal of the Department of Agriculture.*

The following note on the South African Maize Crop is taken from *The Times Trade and Engineering Supplement,* 13th February, 1926.

The lower prices are said to be due to brighter weather prospects and also to the publication of the official figures, which clearly indicate that there is little prospect of a serious shortage of maize for local consumption, even if the drought were to continue. It has been estimated that over 2,500,000 bags of maize still remain in the country as a carry-over from last year's "record" crop of 24,000,000 bags. The most pessimistic estimate of this season's crop is set down at 10,000,000 bags so that there should be enough maize available for local consumption. By comparision with other drought years it would not, however, be unreasonable to expect that this year's crop will be somewhere about 12,000,000 bags. The season 1920-21, a period of drought, yielded 12,296,560 bags, while during 1922-23, another drought year, the total was nearly 13,500,000 bags.

A WILT DISEASE OF BANANAS.

A Bacterial Wilt Disease of Bananas in Trinidad caused by *B Solanacearum* E. F. Sm.

IN 1910, and again in 1911, J. B. Rorer published an account of a bacterial vascular disease of bananas in Trinidad. Affected plants showed a successive wilting, yellowing and breaking down of the leaves until none remained standing; the leaves frequently gave way at the junction of blade and stalk. Internal signs of disease were conspicuous; the vascular bundles of pseudostem, leafstalk, fruitstalk and bulb (rhizome) were yellow brown or nearly black and in some cases cavities were present in pseudostem, bulb and fruitstalk. When affected plants were cut transversely, a white, dirty-white or brown ooze escaped from the severed ends of the bundles; this ooze consisted of a bacterial slime which filled the water-conducting vessels of the bundles. A bacterium was isolated from the ooze in pure culture and produced all the signs of the disease when inoculated into young leafstalks of healthy plants by means of needle pricks or injection. Inoculation of a single young leafstalk with the bacterium, caused on several occasions, a general infection of the vascular bundles of the whole plant and its death within one or two months, and by passage into the buds the death of the whole stool after a somewhat longer interval. The disease was found naturally in different parts of the island in the so-called "Moko" plantain, French and Creole plantains and the Governor or Cavendish banana. It was believed that the wilt had been responsible some fifteen years earlier, for a wholesale destruction of the Moko variety formerly much used for temporary shade in cacao cultivations.

Inoculations showed that Moko, Red Fig, Governor (*M. Chinensis*) and Gros Michel suckers could be infected and killed by the disease, although it had not been found naturally in Gros Michel. The pathogene was named *Bacillus Musæ* by Rorer, but the only cultural character mentioned was a tendency for its growth on steamed white potato slabs to turn brown and often finally black, resembling in that respect *B. solanacearum* already recognised as the cause of a destructive wilt disease of tomato, white potato and tobacco in the United States and the East Indies. Rorer stated, however, that inoculations into solanaceous plants failed to cause infection. Dr. Erwin F. Smith in Washington also isolated the organism from material supplied by Rorer and infected bananas with it, but failed to get infections on tomato, cultivated varieties of which are usually quite susceptible to attack by *B. solanacearum*. He found that the bacterium did not liquify gelatin and this character and its behaviour on steamed potato and apparently negative action on solanaceous plants are all that has been known of it for some fifteen years. During the years subsequent to 1911 the host range of *B. solanacearum* has come to be recognised as very wide, so that in 1924, Palm and Jochems were able to list 128 species of flowering plants in some 35 natural orders known to be susceptible to infection; the disease had been found under natural conditions in about 90 of these species. Of particular interest as involving monocotyledons plants was Jochems record in 1921 of its natural occurrence on two species of Canna (*C. glauca* Rosc. and *C. indica* L.) in the Deli tobacco district of Sumatra, and of its detection later in the same area on two species of Commelina (*C. benghalensis* L. and *C. nudiflora* L.). Pure cultures from Canna were found to infect tobacco and balsam (*Impatiens balsamina* L.) while, in his joint paper with Palm, cultures from Commelina were recorded as infecting Hevea rubber, Castor oil, tobacco and tomato. These authors did not mention any species of Musa among the hosts recorded up to 1924. In December, 1925, F. Stell drew the attention of the writer to a seeming bacterial vascular disease of the so-called Giant banana in a plot planted in May with suckers from Grenada, at an estate near Sangre Grande. From a piece of the pseudostem supplied by him which showed yellow and brown vasculars oozing a dirty-white or brown alkaline slime, a bacterium was isolated, which formed round or nearly round wet shining surface colonies in three to four days on potato extract saccharose agar plates; they tended to flow when the plates were tilted and turned brown a few days later. The organism was a short rod often in pairs and about 1.5 by 0.5 microns in size and showed polar staining in smears and motility in young broth cultures. On steamed white potato slabs the growth, at first dirty-white and wet-shining turned brown after a few days and ultimately, as a rule, nearly jet black. Lavender colour litmus milk (separated) began after three days to turn blue and this change became gradually more intense; there was no clot and no surface growth but a dirty-white deposit and after a month the alkaline milk became translucent. After the organism had been in culture for six weeks a three days' culture on potato extract saccharose agar was taken to the estate and inoculated by means of needle pricks near the upper ends of the pseudostems of three Giant banana suckers in two stools in a part of the plot where disease had not appeared; three suckers on two adjacent stools were pricked with a sterile needle. Inoculations were made from the same culture in a similar way on the same day into four young suckers in two stools of Gros Michel in an adjacent plot where there had been no cases of disease, also into a sucker of Red Fig and a sucker of Sucrier (lady's finger) in another part of the estate. On this estate Moko had been used many years ago as a shade for young cacao, but was killed out by disease and not a stool is now present. The "Giant" plot had been planted on land cleared from forest but adjacent to cultivated cacao and Hevea rubber. A case of the same disease was found on the Red Fig and the same bacterium was isolated from discoloured vasculars

in the pseudostem. The external and internal signs of the disease on the Giant and Red bananas were in full agreement with those described and illustrated by Rorer. The inoculated plants were examined seven weeks later but the result was negative on the Giant and Red bananas. Three of the four inoculated Gros Michel suckers showed some wilting and withered leaves and many vasculars in the pseudostems were yellow or brown and could be traced down into the bulbs where many vasculars were discoloured and showed bacterial ooze. The inoculated bacterium was recovered by means of poured plates from vasculars in the pseudostems and bulbs. Two leaves had withered on the inoculated sucker of Sucrier and discoloured vasculars were present in some sheaths of the pseudostem and the inoculated bacterium was recovered from such vasculars 30 cms. below the inoculation pricks. There were no other cases of the disease in the Gros Michel plot. It may be added that the inoculations were made during very dry weather. As the inoculations had shown that the bacterium was able to produce the disease in bananas and as it showed the characters of *B. solanacearum* in culture, inoculations were made into tobacco and tomato. Young cultures of the isolations from the Giant and Red Figs were pricked into the stems of two young tomato plants about eighteen inches high and a tobacco plant about six inches high, growing in pots in a glass house; these plants were making normal healthy growth; they were kept in a damp chamber for some hours before inoculation and for twenty-four hours following it. After a few days one of the tomato plants showed adventive roots pushing for several inches above and below the inoculation pricks and some leaf petioles reflexed. Growth became stagnant and after a week a dark streak extended for three inches above the higher prick and one leaf wilted at this point. The inoculated bacterium was recovered from the brown vascular region in the midrib of this leaf, only the one kind developing on the plates After two weeks the plant began to make appreciable growth and continued to develop in a normal way till it broke across at the inoculated part two weeks later. At this point the pith was destroyed and a browning of the vascular region could be traced above it for five inches The other inoculated tomato plant showed pushing of adventive roots above and below the pricks and not very marked reflexing of petioles, but no leaves wilted and the plant was still growing normally five weeks later. The tobacco plant showed a one-sided wilt of a leaf six days after inoculation and the leaves then wilted successively; at the end of seventeen days all the leaves had wilted and gone dry, except a rosette of small leaves at the apex of the stem and those showed flabby tips; during this period growth was stagnant. The inoculated bacterium was re-isolated from the midrib of a wilting leaf after nine days, and from the midrib of an apical young leaf after sixteen days. The plant was cut up twenty-five days after inoculation and the vascular region found to be browned throughout the stem which showed dirty-white bacterial ooze from the severed base which yielded stained smears agreeing with the characters of the isolated organism. The bulk of the roots were healthy in appearance. The failure of the leaves which was at first frequently on one side of the midrib took the form usually of dry reddish-brown papery patches between the main veins.

Young cultures re-isolated from the tomato and tobacco plants mentioned above were inoculated by needle pricks into the stem of a healthy tomato plant about thirty inches high which had been used as a control for the earlier experiment, and into the stem of a healthy tobacco plant about nine inches high. Cultures from both tomato and tobacco were used for each of these plants. Reflexing of petioles and wilting of leaves had begun on the tomato plant in four days and after eight days all the leaves had wilted and adventive roots had pushed abundantly on the stem, which showed dark streaks within the cortex. The inoculated bacterium was recovered by means of poured plates from the midrib of a leaf near the top of the plant. It was cut up after two weeks and browning of the vascular region found to be general throughout stem and leaf stalks; from the severed base of the stem there was abundant dirty-white bacterial ooze but the bulk of the roots were of normal colour.

The tobacco plant showed one leaf wilting after four days and the leaves continued to fail successively with development of brown patches frequently at first on one side of the midribs. After eighteen days the inoculated organism was recovered from the veins of a wilting leaf. In nineteen days all leaves had dried up except a rosette of six small leaves at the apex of the stem and three of these were flabby. The plant was cut up and browning of the vascular region found to be general throughout the stem with bacterial ooze from the severed base; the root system was normal in colour and development. It was evident that passage through tomato and tobacco plants had enhanced the virulence of the pathogene to tomato and tobacco. Cultures re-isolated from Gros Michel and Sucrier bananas were also inoculated into a tomato and a tobacco plant. The tomato plant had forked into two nearly equal branches; one of them was inoculated by needle pricks. This branch made practically no growth for ten days while the other grew vigorously. Adventive roots appeared on the inoculated branch and a brown streak within the cortex, but there was no wilting of foliage and after a month this branch was growing freely, although much behind its fellow. On the tobacco plant leaves began to wilt after seven days and continued to fail progressively but slowly while the plant made appreciable growth. After eleven days the inoculated bacterium was recovered from the midrib of a wilting leaf. At the end of a month there were still some of the larger leaves in all stages of wilting and drying up and a rosette at the apex of the stem of small

dark green leaves some of which had flabby tips. The plant was cut up and browning of the vascular region found to extend through the stem and into the leaf stalks of the older leaves; the severed base yielded bacterial ooze while the roots appeared normal. These inoculations on tomato and tobacco showed that the bacterium isolated from wilting varieties of bananas multiplies in the vascular tissues of tomato and tobacco and is pathogenic to these plants causing sysmptoms identical with those recorded for *B. solanacearum*. The morphological and cultural characters of the banana bacterium as far as they have been observed are also in agreement with those of *B. solanacearum*.

It seems justifiable to regard that species, therefore, as the casual agent of the bacterial banana wilt in Trinidad. It may be added that the inoculations were done in a glass house at the height of the dry season, consequently under conditions of very low atmospheric humidity but of relatively high temperature. The inoculations into varieties of bananas in the field gave rather unexpected results, they were in agreement with the well known capricious behaviour of *B. solanacearum* towards individual plants of quite susceptible varieties. Erwin F. Smith has pointed out that it rapidly loses virulence in artificial culture (Rorer found his cultures from bananas to behave similarly) and infers also that single plants of susceptible varieties may vary notably during growth, in resistence to attack. A repetition of inoculations into varieties of bananas would doubtless give different results.

It is probable that the infection of the Giant bananas in the plot came from the soil, as plots planted in other parts of the island from the same batch of imported suckers have not shown the disease. With the advent of the rainy season various weeds growing in the infected plot will doubtless show evidence of attack. *B. solanacearum* is apparently able to enter only injured roots of tomato, tobacco, potato, &c., such injuries may be caused in transplanting also by insects and nematodes, insufficiently rotted plant residues applied as manure to young plants, in light soils by dry weather and in close textured soil by water-logging. The plot in question should prove useful for determining the resistence and susceptibility of varieties of bananas to the disease. The external and internal signs of the bacterial wilt of bananas are very similar to those of Panama Disease. That disease, however, is due to invasion of the water-conducting vessels of the vascular bundles by the hyphal threads of the fungus *Fusarium Cubense* (E. F. Sm.) Brandes; the vasculars are coloured yellow and characteristically dull crimson and do not ooze a white or brown slime. While inoculation of a single leaf stalk may result in general infection of the plant by the bacterial disease, this has not been observed in Panama Disease. The susceptibility of varieties of bananas to the two diseases is not the same. Giant Fig and Governor are highly resistant to Panama Disease but apparently quite susceptible to the bacterial disease. The resistence of Gros Michel to the bacterial disease has yet to be determined under field conditions where infection may be expected to occur normally from the soil. It is remarkable that the wilt of bananas due to *B. solanacearum* should not have been recorded from the East especially from Sumatra where it has been for many years destructive to tobacco and has a large number of other hosts including several monocotyledons.

S. F. ASHBY.

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SUGAR BEET IN LOUISIANA.

ACCORDING to an article in the *Planter and Sugar Manufacturer* for 10th April, 1926, the testing of the growth of sugar beets under field conditions in Louisiana has attracted a considerable amount of attention in the sugar producing world. Trials have been made in the planting of sugar beets on some thirty Louisiana sugar-cane plantations at various intervals from November to February, and these trials show that beets have withstood one of the worst winters in the history of the Louisiana sugar industry. In the past, sugar beets have been grown in districts not suited for the cultivation of the sugar-cane. The experiment in Louisiana, which has now extended over several years, and during the past season has been conducted on a considerable scale, indicates that it may be possible to grow the sugar beet and the sugar-cane in the same localities. If further trials prove that this can be done on a practical basis it should mean a great improvement in Louisiana's status as a sugar producing section. Sugar factories will be able to operate over a longer season each year and the many advantages which should follow the cultivation of plants so different in their characteristics as the beet and the sugar-cane, should result in considerable improvement in the management and maintenance of sugar estates.

Subscriptions to Lord Milner's Appeal for £100,000 as an endowment fund for the Imperial College of Tropical Agriculture should be addressed to the Secretary, Imperial College of Tropical Agriculture or to the bankers of the Fund, the Colonial Bank, 29, Gracechurch Street, E.C.

PORTO RICO EXPERIMENT STATION.

THE report of the Porto Rico Agricultural Experiment Station for 1924 has recently (January 1926), been issued. The report of 29 pages is well illustrated with reproductions, of photographs and contains interesting accounts of the Experimental work during the year covered by it.

The Director remarks that although Porto Rico was settled by Europeans a century before permanent settlements were established on the mainland, the agriculture of the island was in a low state of development when the Agricultural Experiment Station was established in 1902 and as a consequence the Experiment Station was unable to confine its efforts to reasearch, which is its legitimate function, and was of necessity forced to do much pioneering work in the introduction of new methods, growing of new crops and the improving of old ones. With the development of the insular Department of Agriculture in 1917, it became possible for the station to turn its attention more and more to the problems of research connected with tropical agriculture. That progress has been made and Porto Rican agriculture is on a higher plane than formerly, is abundantly to be shown in the great increase noted in all lines of agricultural production. The cost of research is increasing although the income of the station is almost stationary; research in tropical agriculture is comparatively new and there are no limits to its possibilities. Men are desired at the station for urgently-needed investigations, who, when secured should be encouraged to remain with the work until the problems are solved.

Sugar-cane is the leading crop of the Islands. The rapid increase of the area under sugar-cane had resulted in neglect of rational systems of cultivation. Continued cultivation of cane without rotation crops had resulted in problems peculiar to cane cultivation, and results obtained on the station show that next to the practice of rotation a change of cane varieties is advisable. The growing of immune varieties proves to be the most successful means of combating the Mosaic disease which for a time threatened the sugar industry. The work of the Station in averting complete ruin of the industry was appreciated by the main growers in the section which received the greatest benefit from the introduction of immune varieties, and this appreciation has been expressed by the presentation from planters and sugar growing companies of a cup and a memorial to the station. With reference to the planting of sugar-cane it is emphasised that only sound, clean cuttings should be planted and these should be given a good start to enable them to make a good growth. To prevent the introduction of the cane borer into the field with the cane cuttings it is stated that all infested cuttings should be soaked before planting in a solution, which penetrates the borer tunnels and kills the borer. It was found that when the cane cuttings were soaked for twenty-four hours in water, in saturated lime water and in lime water and magnesium sulphate the borers were all killed, and that the germination was improved. The improvement, however, was greatest in the case of those plants which were soaked in lime water and magnesium sulphate and that this improvement was manifested in the final yields of cane at the time of harvesting.

Suitable progress is recorded in the improvement of live stock particularly for dairy purposes and diary practices are stated to be improving. An increase in the production of forage grasses is primarily the cause of the increase in the number of cattle found in the Island. Elephant grass, Guatemala grass and velvet beans which make rapid growth, are greatly relished by cattle and have high value as stock food. Such crops are converted into beef, milk and butter with the least expenditure of energy and money.

The Horticulturist devoted a very considerable amount of time to the study of the effect of variation in day length on blossoming and growth of certain local plants and very positive and interesting results were obtained. Although planting may be made every day in the year in Porto Rico so far as temperature is concerned, plant growth is invested to such an extent by any variation in the normal day length as to make the planting season in many instances a deciding factor for success or failure.

The Plant Breeder has carried on extensive work in field corn for experiments for the development of drought resistant varieties and for the development of a high yielding variety suitable to Porto Rican conditions, and this work appears to have yielded very encouraging results. In the work with sweet or sugar corn, cross breeding with a vigorous form of sweet corn from the north and a field corn, has resulted in the production of a sweet corn apparently well suited to the tropical conditions of Porto Rico.

In connection with pine-apple investigations the agriculturist has been making a study of certain unsuitable areas which are often apparent shortly after the pine-apples have been planted. The problem of making an unsuitable soil suitable, is being solved by noting the effect of trench sub-soiling and the application of organic matter and various inorganic limes on the crop. The results would seem to indicate that a sub-soiling in which the soil is brought from a depth of eighteen or more inches to the surface usually benefits the plant. The application of organic matter such as manure, straw or muck has been beneficial in all cases. Sulphur can be recommended for use on a soil containing little limestone but not where coral sand is the predominant constitutent.

Readers are requested to inform the Editor immediately of any change in address.

VALEDICTORY.

PROFESSOR S. F. ASHBY who has resigned his position on the College Staff to take up the duties of Mycologist, Imperial Bureau of Mycology, left Trinidad by the Elders & Fyffes s.s. *Camito* on the 21st April.

Professor Ashby received the degree of Bachelor of Science at Edinburgh University, and has since held the following positions: Carnegie Scholar and Fellow, Rothamsted Experimental Station, 1903-06; Bacteriologist and Fermentation Chemist, Jamaica, 1906-10; Microbiologist, Jamaica, 1912-21; Mycologist, Imperial Department of Agriculture, 1921-22; Professor of Mycology and Bacteriology, Imperial College of Tropical Agriculture, 1922-26. Appointed Mycologist, Imperial Bureau of Mycology, 1926.

Professor Ashby has been an enthusiastic investigator and research worker, and has published a considerable number of valuable papers. A list of his papers, published during the College Year 1924-25, appeared in the Annual Report of the Principal, which was published in the College Prospectus for 1926-27 and reproduced in the April number of *Tropical Agriculture*. Other papers which may be mentioned are:

The Nitrogen cycle and Soil Organisms, *West Indian Bulletin*, Vol. VIII, 1907.

Two diseases of Coconut Palm in Jamaica due to *Phytophthora* sp., *West Indian Bulletin*, Vol. XVIII, 1909.

Oospores in cultures of *Phytophthora faberi*, *Kew Bulletin*, No. 9, 1922.

The Fungi of Stigmatomycosis (with W. Nowell) *Annals of Botany*, Vol. XL, 1926.

Professor Ashby was a regular contributor to the publications of the Jamaica Department of Agriculture, to the *Agricultural News* and to *Tropical Agriculture*.

In his new field of work Professor Ashby will have the best wishes of his colleagues at the Imperial College of Tropical Agriculture, for all success and every happiness.

PINK BOLLWORM IN NYASALAND.

ACCORDING to a note in the Journal of the Department of Agriculture of South Africa for March, 1926, the Division of Entomology of the South African Department of Agriculture has been officially informed by the Department of Agriculture, Zomba, that the pink bollworm of cotton has been found in the northern extremity of the Nyasaland Protectorate. It is stated that drastic control measures are being taken. The region concerned has only water communication with the southern districts and a belt of 150 miles of non-cotton country lies between the areas. Cotton culture must cease in the infested areas, and has been prohibited in the intervening country.

AGRICULTURAL REPORTS.

THE report on the Agricultural Department, Dominica, 1924-25, has just been issued. The report contains a good deal of valuable information and the accumulated experience obtained from the lime experiments should be as much assistance in the present critical period. Interesting accounts are given of the examinations of and reports of a variety of exhibits which were sent from Wembley to the Imperial Institute.

THE report on the Agricultural Department of St. Lucia, 1924, indicates much steady work and the establishment of Alfalfa as a seed producing plant in the Island during the year under review is worthy of note. Work has been done along the usual lines with the major and minor crops of the Island and considerable development has continued to be made in the extension of the banana cultivation.

THE report on the sugar-cane experiments for the seasons between 1923 and 1925 by Professor D'Albuquerque has been issued by the Department of Agriculture, Barbados. This report is much smaller and more compact than previous reports, as it has been greatly abbreviated by the omission of details that are only of interest for purposes of department record and comparison. The essentials of the work reported on are recorded and the report indicates that work has proceeded during the season under review along the lines which have been followed for many years in these sugar-cane experiments in Barbados.

THE report for the year 1924 of the Agricultural Department, Antigua, has recently been received. The report contains a record on steady work maintained under exceptional difficulties along lines of previous years. There do not appear to be any outstanding points requiring special comment.

WE have received from the Mirrlees Watson Co., Ltd., Engineers and Founders, Scotland Street, Glasgow, the following Spanish editions of their various Sugar Machinery Pamphlets, which have been specially printed for circulation in Cuba and the Argentine Republic.

S. 40A. "Mirrlees Sugar Mill Rollers."
S. 60A. "Meinecke Patent Chute."
S. 350A. "The Regulation of Multiple Effect Evaporators."
S. 80A. "Searby Cane Shredder."
S. 460A. "Peck Revolving Juice Strainer."
S. 120A. "Mirrlees Revolving Cane Knives."
S. 120B "Mirrlees Revolving Cane Knives."
S. 610A. "Mirrlees Oil Mill" Catalogue.

Copies of these Pamphlets can be had on application to the above address.

REVIEWS.

ELECTRICITY IN AGRICULTURE—By Arthur H. Allen, Sir Isaac Pitman & Sons, Ltd., London. Price 3s.

This is an instructive little book developed on similar lines to the previous one. In it will be found a considerable amount of useful information on the application of electricity to the various branches of agriculture. Electricity supply, distribution, domestic application, pumping, irrigation, electroculture and other related topics are also discussed. We highly recommend the book to any reader desirous, without lengthy study, of becoming familiar with the many and varied uses to which electricity can be put on the farm, in the dairy and in the home.

J. SYDNEY DASH.

ENGINEERING AND THE PREVENTION OF MALARIA. By Henry Home, M.Inst.C.E. 185 pages, fully illustrated. Demy 8vo, 13s. 6d. net, postage 6d. Chapman and Hall, Ltd., 11, Henrietta Street, Covent Garden, London W.C. 2.

This excellent book shows the application of the known methods of mosquito control in a concise and practical manner. It is pleasing to note the plea for specific sanitation in dealing with the problem of Malaria. This is very necessary, as even to-day, one sees in different parts of the world, large sums of money wasted on mosquito prophylaxis on entirely false assumptions. The work is often carried out against pestiferous mosquitoes in general or against a wrong species of anopheline, or worse still, the control measures, create a condition which invites a worse species of carrier to breed. Adaptation in the breeding habits of various species, are not always taken into account, and neither is cognizance taken of the conditions of flight. Frequently, after investigation of mosquito control work, one gets the idea that very much better and cheaper work could have been attained by a little more careful and expert preliminary investigation of the problem. The book deals, very helpfully, with the treatment of tidal lands and lowland swamps, which frequently are very difficult propositions. The treatment of impounded water areas, is not dealt with specifically, but, of course, follows on general principles. There is a note on dynamite ditching which is a very excellent method, and should be more widely used. It should be remembered that in soft country, silt and sand will block graded stones if used above tile pipe sub-soil drains. There are very welcome chapters on the hydrogen ion concentration of water with relation to the breeding of mosquitoes, and the proper methods of guaging mosquito netting. In mosquito control attack, the order of importance of the measure, as laid down by Colonel Gorgas, holds good to-day. First, drainage; second, bush and grass cutting; third, oiling; fourth, larvacides; fifth, screening of houses; sixth, quinine prophylaxis; and seventh dealing with mosquitoes in quarters. An additional measure to the list, is the stocking of cisterns and ponds with larvivorous fishes.

The whole subject is put in an assimilable form, and the illustrations, especially the photographs taken from a film, released by The British Instructional Films Limited, are very good. We can heartily recommend the book, and consider it should be read by everyone interested in the work and welfare of the tropics and sub-tropics.

E. A. SEAGAR.

An advertisement of this book appears in the Advertising Pages of this number of *Tropical Agriculture*.

EAST AFRICAN PASTURE PLANTS.—1 East African Grasses. Published by the Crown Agents for the Colonies, 1926, Price 2s. 6d.

THIS excellent little handbook of 55 pages with index, is so well described as to its origin and preparation in the Preface, that the Preface is reproduced herewith.

So little is known about the pasture plants of our tropical dependencies that officials and residents find considerable difficulty in recognizing them and becoming acquainted with their economic properties. Especially is this the case in Tropical Africa since there is no convenient book on the subject written in simple language.

It seems desirable, therefore, to investigate the more important pasture plants, whether affording good fodder or possessing properties inimical to stock, and to provide a ready means for their identification in the field without reference to home institutions.

It is hoped that the original drawings prepared for the first contribution, together with the descriptions drawn up from the specimens in the Kew Herbarium, will enable the plants to be identified in East Africa even by those who may not have had the advantage of a previous botanical training.

In the introduction a typical grass plant is described and details of the floral structure are given. This is followed by a simple account of the general principles on which the classification of the grasses is based. The species described follow the arrangement of the Flora of Tropical Africa. Should this series of illustrations and descriptions stimulate, as is hoped, a desire for further knowledge of the native plants on the part of officials and residents in East Africa an endeavour will be made to prepare, with their co-operation, a complete flora of this very interesting botanical region.

The present publication originated from a suggestion made by Dr. E. Montgomery, Veterinary Adviser to the Governments of Kenya,

Uganda and Tanganyika Territory. It has been prepared at Kew for those Governments and has been confined to descriptions and illustrations of twenty grasses which occur commonly in the East African pastures. The selection of these grasses has been made at Kew and the discussion accompanying each description has been compiled from the field notes accompanying the herbarium specimens and from other sources.

The text has been written by Mr C. E. Hubbard and the original drawings are by Mr. W. E Trevithick, both of whom are botanical assistants in the Herbarium. Mr. J. Hutchinson was responsible for the selection of the grasses chosen and for the general compilation and the handbook. —*Royal Botanic Gardens, Kew, January, 1926.*

A.W.H.

SUGAR—By Geoffrey Fairrie. Fairrie & Co., Ltd., Liverpool. Price 12*s.* 6*d.*

Some time has elapsed since any new book of a general nature on sugar has appeared and while the present volume purports to present nothing that is new in sugar growing, manufacture or refining, the author has succeeded in bringing together a wealth of information on this commodity —both cane and beet—and expressed it in language which the non-technical reader will readily appreciate. The volume is particularly replete with photographs and lucid drawings of machinery and processes scantily represented in other works on the subject, of a more technical nature. Teachers and students alike will be grateful for such valuable aids.

The book aims at comprehensiveness, nevertheless the agricultural side of the industry has given place almost entirely to the manufacturing and refining sides. In a work of this size—234 pages—few, if any of the topics can be treated in great detail, but chapters V and VI dealing with modern refining, particularly the treatment of the raw product with charcoal and decolorising carbons, stand out prominently. The following are the main divisions of the subject: I.—What sugar is—how plants make sugar—artificial production of sugar. II.—Outline of production of raw cane sugar. III.—Outline of production of raw beet sugar. IV.—Production of unrefined direct consumption sugars. V.—Modern refining. VI.—(1) Crystallisation, separation and finishing; (2) charcoal and decolorising carbons. VII.—Old time methods and their development. VIII.—Sugar and the human body. IX.—Maple, palm and sorghum—sugars other than sucrose—invert sugar—molasses and syrup. X.—Polarisation and examination of raw sugar. A number of statistics, references and an index conclude the volume.

There are one or two statements a little wide of the mark in connection with the manufacture of Demerara crystals and the reasons why sugar is not refined at the cane factory; these, however, do not detract from the value of the book as a whole. A striking feature is the freedom of the text from the usual cut-and-dried methods of presentation. Excellently printed and efficiently illustrated, it forms a welcome addition to existing sugar literature.

J. SYDNEY DASH.

TOBACCO—By A. E. Tanner. Sir Isaac Pitman & Sons, Ltd., London. Price 3*s.*

This forms one of the Pitman series of handy volumes which have appeared on various topics, both agricultural and industrial. The author, familiar with the working of the customs and excise laws relating to tobacco, gives in the opening chapter an instructive sketch of the history of the trade. In the following chapter the cultivation of the crop is briefly treated, while the remaining chapters are devoted to the manufacturing processes; the different types of tobacco, cigarette and cigar manufacture are adequately dealt with for a book of this size. In 114 pages the author has succeeded in condensing a great deal about his subject, which will be of interest as much to the student as the casual reader.

J. SYDNEY DASH.

SUGAR NOTES.

UP to 4th March, the St. Kitts Sugar Factory at Basseterre, had manufactured 2,200 tons of sugar from 19,709 tons of cane.

The new central sugar factory in St. Thomas in the East, Jamaica, was opened on 26th February, by His Excellency the Acting Governor. The factory is capable of producing 10,000 tons of sugar and can be expanded as circumstances require, to produce 20,000 tons per annum.

BANANA NOTES.

MR. SWIFT, of the Swift Banana Company, recently visited St. Lucia in connection with the recently established banana industry. The Company is registered in England with a capital of £100,000 and has acquired large tracts of land and options on many thousands of acres of Crown Lands. Contracts have already been signed with a ship-building company for the construction of steamers for conveying fruit, and it is expected that the first of these vessels will be ready about March, 1927. The steamers will have a capacity of about 60,000 stems and two will call every five weeks. Buying depôts will be established at suitable points throughout the Colony. It is intended to develop plantations as rapidly as possible, consistent with good cultivation.

In reply to a question asked by Mr. A. E. Jacob, M.P., in the House of Commons on 22nd March, Mr. Samuel said that 12 million stems of bananas were exported from Jamaica during 1924 and 15 million stems during 1925. Of these, approximately 1¾ millions and 2½ millions respectively were sent to the United Kingdom.

OBITUARY.

PROFESSOR L. C. A. KNOWLES.

IT is with deep regret that we have to record the death of Professor L. C. A. Knowles, at her residence in London on 26th April. Professor Knowles, who was trained under that great economic historian, Archdeacon Cunningham, was appointed lecturer in Modern Economic History at the London School of Economics and Political Science in 1904, when, as she was proud to recall, the school consisted of a mere handful of "cranks." The subsequent development of the school of economic history at this institution has been due in large measure to her unquenchable enthusiasm, wide sympathies, and proselytising power. In addition to academic work she served upon the Departmental Committee appointed in 1918 to enquire into and report upon the cost of living in the working classes, and was a member of the Royal Commission on the Income Tax 1919-20. She was also a member of the Councils of the Royal Economic Society and the Royal Historical Society. Since 1920 she had been Dean of the Faculty of Economics in the University of London. Among her publications "The Industrial and Commercial Revolutions in Great Britain during the Nineteenth Century," and "The Economic Development of the British Overseas Empire 1763-1914," deserve special mention, the latter being reviewed in the January, 1925, issue of *Tropical Agriculture* (Vol. II. No. 1, pp. 16-18). Our readers will remember that Professor Knowles contributed an article on "Colonial Policy" in the August, 1925, issue of this Journal (Vol. II. No. 8. p. 170-2) and it was hoped that shortly another article from her distinguished pen would be received. Recently Professor Knowles was engaged upon a companion work to her "Development of the Overseas Empire," dealing particularly with the self-governing colonies.

The world has lost one of its most eminent economic historians at a time when her mature experience was just becoming available to the wider public by means of her scholarly publications. Professor Knowles took an unusually keen interest in the after career of her honours students, and those who had the privilege of being trained under her direction will feel that they have lost not only a great teacher but also a very great friend.

C. Y. SHEPHARD.

COTTON NOTES.

SEA Island cotton is selling locally in St. Vincent at 3*s*. 6*d*. per lb.

Sir Austin Chamberlain in reply to a question asked by Mr. Scurr in the House of Commons, stated that under the terms of the Sudan Plantation Syndicate's concession, 40 per cent. of the proceeds realised by the sale of the cotton crop was paid to actual tenant cultivators.

WEST INDIES.

MR. ALGERNON ASPINALL, C.M.G., C.B.E., Secretary of the West India Committee, who is also Secretary for the Imperial College of Tropical Agriculture, gave a talk about the West Indies, broadcast from 2LO London on 18 March, 1926.

Mr. Aspinall who has for many years made a particular study of the West Indies gave an interesting account of the Islands, referring to their discovery by Columbus, mentioning their coral and volcanic origin and emphasizing the patriotic attachment of the inhabitants of these islands to the Home Country. Mention was also made of the exploits of the heroes of the British Navy in West Indian waters during those years of the eighteenth and early part of the nineteenth century when the Navy was establishing itself and making England mistress of the seas. Reference was also made to the improving condition of the West Indian Islands for winter tourists from temperate countries seeking health and recreation while avoiding the rigours of a northern winter. In speaking of the staple products of the West Indies, Mr. Aspinall referred to the sugar and cacao crops, the famous Blue Mountain coffee of Jamaica, St. Vincent arrowroot and Jamaica rum, the special value during the war of West Indian mahogany for use as propellers for aeroplanes, and Sea Island Cotton which was used for the wings of airplanes and for "blimps," and the fuel oil from Trinidad is emphasised. The Pitch Lake of Trinidad is referred to as one of the wonders of the world and its utility in producing upwards of 200,000 tons of asphalt yearly, is mentioned.

In reference to the opportunities for young men in the West Indies, Mr. Aspinall mentioned that climatic conditions are not suitable for white people to perform manual labour in fields for any length of time but that young men often find employment as overseers on sugar and others estates where they may rise to positions of authority with good pay, and to the opportunities for young and energetic men with a sufficient amount of capital to invest as planters of such crops as coconuts, coffee and fruit. The development of a fruit industry should be rapid if suitable steamship services are developed for carrying the fruit under favourable conditions. Reference is made to the work of the Imperial College of Tropical Agriculture and to the wide distribution of students who have already taken courses at that institution The broadcast ends by saying "it was on the wealth of the West Indies in the eighteenth century that the industrial prosperity of Lancashire was built up, now in the twentieth century these Colonies are through the Imperial College once more helping to secure the economic development of the Empire."

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture*, post free, to anyone interested in tropical development.

COLLEGE NEWS.

Dr. H. R. Briton-Jones and Mrs. Briton-Jones arrived by the s.s. *Ariguani* on 24th April.

Dr. E. J. Maskell, Assistant Plant Physiologist of the Cotton Research Station and Mrs. Maskell and son, arrived in Trinidad on 1st May.

Dr. Henry McLaren, LL.D., M.I.Mech.E., Director of the firm of J. and H. McLaren, Ltd., Leeds, England, and Miss McLaren were visitors to the College recently.

The College was visited recently by Messrs. Sydney G. Young and R. N. Lupton, Masters at Harrison's College, Barbados, and Mr. A. James Pocock, Kingston, Jamaica.

Mr. Robert S. Reid, prominent planter in Tobago visited the College on 28th April, and was conducted over the College buildings by Professor Shephard.

Since the arrival of Dr. Briton-Jones, the Mycological Department has been transferred into the New Building, vacating the old Mycological laboratory which will be at once occupied by the Department of Tropical Sanitation and Hygiene.

Dr. P. H. Rolfs, who is in charge of the development of the Escola Superior de Agricultura e Vetinerara at Viçosa, Minas Geraes, Brazil, and Miss Clarissa Rolfs visited the College on 28th April. Dr. Filisberto C. Camargo, Director of the Federal Station, Estacas Pomocultura, Deodora, Rio de Janeiro, Brazil, accompanied them.

The College has received as a gift from the West India Atlantic Group Committee of the British Empire Exhibition through Mr. Algernon Aspinall, Hon. Commissioner, the flagstaff which for two years stood in the garden of the West Indian Pavilion at Wembley. The flagstaff which is sixty feet high has been erected in the College grounds near the Old Building.

The Science Club has held two meetings. At the first meeting on 25th March, the Club was organised and officers appointed, after which the Hon. W. G. Freeman, Director of the Trinidad Department of Agriculture gave a very interesting lecture on the Forest Flora of Trinidad illustrated by excellent lantern slides. At the second meeting Dr. Harland gave an interesting account of his trip to the far East. Dr. Harland was unable to complete the account of his trip and his lecture will be continued at the next or some subsequent meeting.

Sir Francis Watts, *Principal Emeritus*, addressed a meeting of the Naparima District Agricultural Society of Trinidad recently, giving a talk about coffee in Trinidad. The considerable importance of coffee as an agricultural product in the past was mentioned, the decrease in the crops in more recent years and the decided increase in the export of this commodity in the last two years was emphasised. In 1925, the exports of coffee from Trinidad amounted to 593,000 lb. with a value of £28,000. Reference was made to the several varieties which are considered suitable for planting in Trinidad and sound advice given in regard to the cultivation, harvesting and marketing of the crop.

Mr. L. C. C. Liebenberg has accepted an appointment of Assistant Geneticist on the staff of the Department of Agriculture, Barbados. The Barbados Department of Agriculture has been re-organised and its staff considerably enlarged while a much wider range of experimental work and research is being planned by the Director, Professor J. D. d'Albuquerque. Mr. Liebenberg who is at present a Post-Graduate student at this College has received his previous training at the Transvaal University College, Pretoria, and at McDonald College of McGill University.

Messrs. E. H. Bentall & Co., Ltd., Heybridge, near Maldon, Essex, England, who are manufacturers of Coffee Plantation Machinery, have made a present to the College of coffee machinery of a net value of £52 10s. 0*d*. with the idea that it would be useful to the College for the purpose of familiarizing students with the best means of treating coffee on the plantation. The machinery consists of 1 Bentall Jamaica Pulper, complete with one spare copper cover, and 1 Smout Peeler and Polisher (18 in.) with fan, complete. This gift is greatly appreciated and will provide the means of demonstrating the processes of preparing coffee for the market in connection with instruction in crop technology, and the thanks of the College are due to Messrs. Bentall & Co.

Professor Shephard who visited British Guiana during the Easter Vacation for the purpose of investigating the system and working of the local Co-operative Credit Societies returned to Trinidad on 26th April by the R.D.M.S. *Commewijne*. While in the Colony Professor Shephard, in addition to holding a number of conferences with the officials of the Directors' Office, attended committee meetings of the Canal Bank No. 1 and Buxton Societies and visited the Suddie and Anna Regina Co-operative Banks. He also paid visits to several sugar plantations and rice mills. Thanks are due to Mr. G. L. Beccles Gall (Director), Mr. Shankland (late Director), other Government officials and private individuals, whose kind co-operation and hospitality enabled him to cover so much ground during the short time at his disposal.

ADVERTISEMENTS.

MR. HENRY H. R. MOLE, of Little Neck, Long Island, New York, has been appointed advertising agent for *Tropical Agriculture* in the United States of America and Canada. All communications from those countries respecting advertisements should be addressed to him.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—The Cuban situation has been the dominating feature of the sugar market. It is reported that the Executive Council of Cuba has approved of a plan to reduce the production of sugar in Cuba by 10 per cent. and to recommend Congress to pass laws preventing over-production during the two coming crops, as well as to delay the beginning of grinding until general authorisation has been given by the Government. Conflicting reports have been received regarding this proposal, but the news has led to a strengthening of futures to which the labour troubles on the Cuban railways have contributed. It is suggested that if this reduction comes into effect European beet sugar growers will seize the opportunity of increasing their output and so counterbalance the Cuban reduction. Stocks in the United Kingdom are exceptionally heavy; the amount of foreign refined is 168,000 tons compared with 22,000 tons a year ago, while stocks of unrefined amount to 246,000 tons, against 125,000 tons a year ago. The cyclone which visited Mauritius is expected to reduce the island's crop from an estimate of 240,000 tons to 200,000 tons. Members of the Parliamentary Delegation which recently visited the British West Indies are agitating for the abolition of the duty against British sugar imported into the United Kingdom. Market prices on 21st April, included Cubes at 31*s.* 3*d.*, Best Granulated at 28*s.* 6*d.*, West Indian Crystallized at 25*s.* and Muscovado at 21*s.* each per cwt., duty paid. Cabled reports give the following prices for 10th May, London, Foreign 96° c.i.f. 11*s.* 9*d.*, Preferential 96° c.i.f. 15*s.* 3*d.*, Yellow Crystals, landed, duty paid 23*s.* 6*d.* to 25*s.* 6*d.* each per cwt., New York, Cuba, 96° c.i.f. $4.25 per 100 lb.

COTTON.—Prices have shown some improvement since our last report and although business continues slow and the markets remain almost featureless there is evidence of an improved undertone. Mid-American realised 10.11*d.*, per lb. spot on 21st April. Cables report Sea Island Cotton c.i.f. at 3*s.* 6*d.* per lb. London on 10th May.

CACAO.—The market experienced a slight upward spurt during the second week in April, but suffered a relapse during the following week to below the level recently prevailing. Stocks in London have risen to 928,000 cwt. or three times the total of 1914 and this factor recurrently exercises a depressing effect upon the market. On 21st April, prices included Ceylon Ordinary at 100*s.*, Trinidad Mid Red at 75*s.*, Grenada Fine at 62*s.* 6*d.*, and Accra Fermented at 42*s.* 6*d.* Trinidad's were quoted at 61*s.* to 63*s.* and Grenada's at 59*s.* per cwt., both L.L.T. on 10th May in London, and 13½*c.* and 12½*c.* per lb., respectively, *ex* quay, New York.

COFFEE.—While the market has remained steady for the finer coffees the poorer types have been weaker. Costa Rica Middling sells at 155*s.*, Kenya Good Middling declined to 115*s.*, and Brazil Santos fetches 100*s.* each per cwt., on 21st April. Some Jamaica Blue Mountain Coffee is selling at 205*s.* per cwt.

TEA.—Demand remains good particularly for Ceylon types. Stocks are lower than at this time last year. Averages on 21st April included Ceylon 23.17*d.*, Indian 21.68*d.* and Java 17.66*d.* each per lb. This year the export trade has been particularly active and the statistical position generally inclines towards the maintenance of higher averages.

RUBBER.—The market has remained in a dull and uninteresting state and prices have experienced an uninterrupted decline since our last report. In spite of the increase in the output of cars in the United States of America, the indifferent weather has retarded the opening of the motoring season. A reduction in the price of tyres is expected and this should help to reduce the stocks in hand. It is interesting to note that values are the same now for all positions from spot to the end of December delivery, namely 1*s.* 11*d.* per lb. Stocks in London amount to 17,054 tons. Cables quote Plantation Sheet at 1*s.* 11½*d.* per lb. on 10th May.

COPRA.—After a recovery prices again returned to their previous levels. Prices on 21st April included F. A. Q. Ceylon to London £30, Sun-Dried Straits to Rotterdam £29 and Straits to Marseilles £28, each per ton. Generally prices have tended to favour buyers. Copra was quoted at £29 15*s.* 0*d.* per ton, c.i.f. in London on 10th May.

GROUND-NUTS.—Appreciable fluctuations in price have been experienced. The rise recorded in our last issue was maintained until the end of the third week in March. A sharp decline then took place, Indian ground-nuts falling from £22 to £20 per ton. Subsequently prices hardened and included on 21st April, Chinese at £21 15*s.*, Nigerian at £21 10*s.* and Indian at £21 5*s.* each per ton.

PALM KERNELS.—Palm kernels at £20 per ton are in good demand both on spot and for May to July consignment from the Colonies. The steady price has considerably facilitated trading. Palm kernel oil remains quite steady at £42 10*s.* per ton, but palm oil is a little cheaper both for hard and soft Lagos. Increased buying is anticipated.

FERTILISERS.—The market is brisk and prices have remained steady throughout March and April at the following levels: Nitrate of Soda 13*s.* 6*d.*, Sulphate of Ammonia 13*s.*, and Sulphate of Potash at 11*s.* 3*d.* each per cwt.